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NATIONAL DAM INSPECTION PROGRAM. CAMP DELMONT DAM (NDI I.D. PA---ETC(U)
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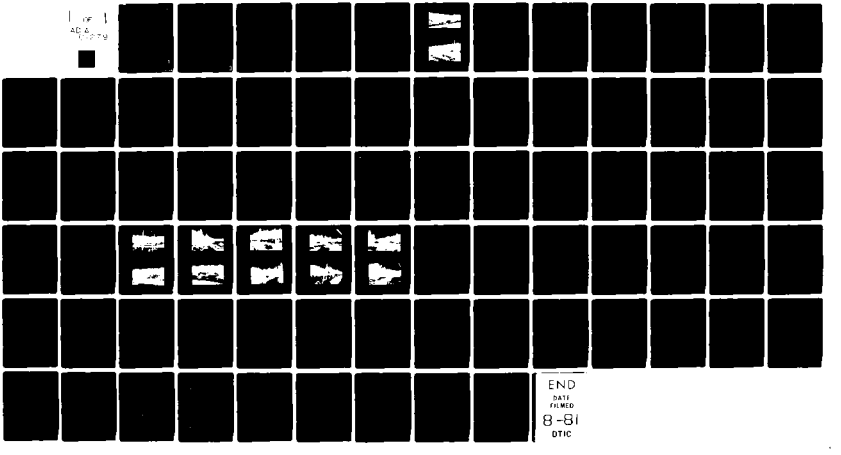

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DELAWARE RIVER BASIN
UNAMI CREEK
PENNSYLVANIA

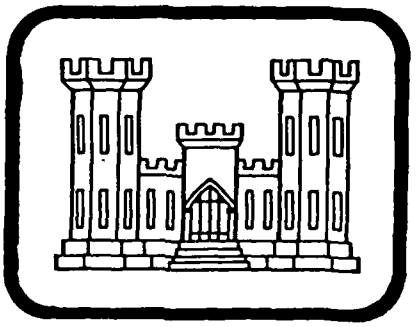
NDI ID PA 00938
PA DER 46-244

LEVEL II

CAMP DELMONT DAM

OWNED BY
BOY SCOUTS OF AMERICA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



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PREPARED FOR
DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND
21203

BY
O'BRIEN & GERE
PHILADELPHIA, PENNSYLVANIA
19103

APRIL 1981

(6) National Dam Inspection Program. Camp Delmont Dam (NDI ID PA 00938, PA DER 46-244), Delaware River Basin, Unami Creek, Pennsylvania. Phase I Inspection Report.

DELAWARE RIVER BASIN

CAMP DELMONT DAM
PENNSYLVANIA

NDI ID PA 00938

OWNED BY
BOY SCOUTS OF AMERICA

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(10) Peter C. Tahos

Prepared for:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(12) 75

Prepared by:

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(15) Contract DACW31-81-C-0016

(11) APR 1981

AD A102163

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT

NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Camp Delmont Dam
State Located:	Pennsylvania
County Located:	Montgomery
Stream:	Unami Creek
Coordinates:	Latitude 40°20.8', Longitude 75°26.3'
Date of Inspection:	December 18, 1980

ASSESSMENT

Camp Delmont Dam is a concrete capped rockfilled timber crib structure with steel and timber sheetpile abutments about 190 feet long, with a maximum height of 19 feet. The dam, which was built in 1947, impounds a lake used for recreation by the Owner, the Boy Scouts of America.

The dam has a maximum storage capacity of 236 acre feet and a maximum height of 19 feet which places it in the "Small" size category. Because of the chance for appreciable damage to several cottages located downstream of the site and little chance for loss of life due to failure of the dam, the dam is judged to be a "Significant" hazard structure. Due to the inhabitable dwellings located downstream of the dam, fifty percent of the Probable Maximum Flood (PMF) was selected as the appropriate Spillway Design Flood (SDF).

An examination of the results of the hydrologic and hydraulic analyses indicates that the spillway and adjacent roadway are capable of passing 36% of the PMF without overtopping the dam abutments. The selected SDF for the dam is fifty percent of the PMF. Since the spillway is not capable of passing the SDF, the spillway is classified as "Inadequate". Further examination of the hydrologic and hydraulic analyses indicates that the spillway and adjacent roadway are capable of passing the 100 year event without overtopping the dam abutments.

Based on visual observations and a review of the information obtained from Pennsylvania Department of Environmental Resources, Camp Delmont Dam appears to be in good condition.

Recommendations and Remedial Measures

The following recommendations and remedial measures should be initiated immediately by the Owner.

CAMP DELMONT DAM
NDI ID PA 00938

a. Facilities

1. The displaced portion of the horizontal planking on the downstream face of the overflow section should be replaced.

2. The control valve for the reservoir drain should be exercised and repaired if necessary.

b. Operation and Maintenance

1. A formal inspection and maintenance program should be developed and implemented to insure that the dam and appurtenances are maintained on a regularly scheduled basis. Maintenance performed should be recorded to provide a history of corrected deficiencies.

2. A formal downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and appropriate agencies should be alerted in the event of an impending failure.

O'BRIEN & GERE ENGINEERS, INC.

Peter C. Johnson, P.E.
Senior Vice President
Pennsylvania Registration No. PE-02246-E

Date: 29 April 81

Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date: 22 MAY 81

OVERVIEW OF THE DAM FROM THE LEFT ABUTMENT.
(12/19/81)

OVERVIEW OF THE DAM FROM THE RIGHT ABUTMENT.
(12/19/81)

TABLE OF CONTENTS

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM
CAMP DELMONT DAM
NDI ID PA 00938
PA DER 46-244

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of this inspection is to determine if Camp Delmont Dam constitutes a hazard to human life or property.

1.2 Description of Project (Based on information obtained from the Pennsylvania Department of Environmental Resources (DER), Division of Dam Safety, Harrisburg, Pennsylvania, and from the field inspection.)

a. Dam and Appurtenances. Camp Delmont Dam is a rockfilled timber crib structure approximately 190 feet long with a maximum height of 19 feet constructed as a run-of-river dam at the southern end of the impoundment.

The overflow section of the dam is 150 feet long, approximately 10 feet high and capped with concrete. Vertical steel sheet piling, which acts as a cutoff, is located along the entire upstream face of the structure. The crest width of the overflow portion of the dam is 10 feet. The 30-foot wide downstream portion of the overflow section is on a slope of 5H:1V. The downstream end of the overflow section is a timber wall about four feet high.

The dam abutments are both 40 feet wide, and are 24 feet long on the left side looking downstream and 15 feet long on the right side. The left abutment is filled with concrete while the non-overflow portion on the right side is filled with earth. A 36-inch diameter corrugated metal reservoir drain pipe is situated in the spillway section approximately 105 feet from the left abutment. A control gate which is located on the entrance to the pipe has a stem that extends to the reservoir surface.

A paved roadway about 30 feet wide is located adjacent to the left abutment. The roadway elevation is about 7 feet below top of dam elevation. Additional discharge capacity is provided (prior to dam overtopping) by the roadway.

b. Location. Camp Delmont Dam is located on Unami Creek in Marlboro Township, Montgomery County, Pennsylvania. The dam and impoundment are shown on USGS Quadrangle entitled "Perkiomenville, Pa" at coordinates N 40°20.8', W 75°26.3', approximately 2 miles east of Green Lane, Pennsylvania. A regional location plan of Camp Delmont Dam is included as Figure 1, Appendix E of this report.

c. Size Classification. Camp Delmont Dam is about 19 feet high and has a maximum storage capacity of 236 acre-feet. The dam is therefore classified as a "Small" dam (height less than 40 feet and maximum storage capacity less than 1,000 acre-feet).

d. Hazard Classification. Several vacation cottages are located along Unami Creek within the first 2 miles downstream of the dam. The dam is classified as a "Significant" hazard structure because of the probability of appreciable property damage, but the chance for the loss of lives is low.

e. Ownership. The dam is owned by the Boy Scouts of America, Valley Forge Council. All correspondence should be directed to: Boy Scouts of America, Valley Forge Council, Route 252, Valley Forge, Pennsylvania (Phone 215-688-6900).

f. Purpose of Dam. The dam was constructed to provide a lake for recreational purposes. The lake continues to be used solely for recreational activities of the Boy Scouts.

g. Design and Construction History. The initial application for construction of a masonry dam in the vicinity of the existing dam was submitted in November, 1944. After a review of comments made relative to the initial application by the Commonwealth of Pennsylvania, Department of Forests and Waters, a rockfilled timber crib structure was selected as an alternate to the original dam proposed. The change in design was primarily due to foundation conditions at the dam site.

The spillway was designed for a capacity of 13,000 cfs at a head of 8.5 feet and discharge coefficient of 3.0.

The application for Construction was approved in July 1946 and construction began in 1947. The contractor was Henkels & McCoy, Philadelphia, Pennsylvania.

The foundation material which was described as sandy-clay was exposed and inspected by the State in February 1947. Boulders were encountered approximately 4 to 6 feet below the foundation surface during test driving of the steel sheet piles.

The Owner notified the State that construction of the dam was completed on October 1, 1947.

No design drawings of the dam are available. However, a review of correspondence indicates that the maximum height of the overflow spillway section above the streambed was 12 feet while the non-overflow abutments were 8.5 feet above the spillway crest. The base width was 40 feet. The upstream face was interlocking steel sheet piles. Information relative to the depth of the sheet piling below the dam was requested by the State, but this information is not available from the Pennsylvania DER files. The crest and downstream slope of the spillway was protected with concrete slabs.

In February 1950, the State inspected the dam site. It was noted at this time that the road adjacent to the left abutment was about 5 feet below the crest of the left abutment crib. This apparently conflicted with design drawings. This matter was brought to the attention of the Owner; however, no further information is available in the Pennsylvania DER corresponding files relative to this situation.

An application was made in April 1968 to repair damage that had occurred to both abutments and to reconstruct each abutment to its original dimensions. The State was notified in December 1969, that these repairs were complete.

h. Normal Operating Procedures. No normal operating procedures exist for the site.

1.3 Pertinent Data

a. Drainage Area.

Square Miles	34.9

b. Discharge at Dam Site (cfs).

Maximum Known Flood at Damsite	Unknown
Maximum Spillway Capacity at Top of Dam	12,555
Maximum Spillway Capacity at Top of Dam (including roadway)	17,041

c. Elevation (Feet above MSL, estimated from USGS Quad).

Top of Dam	279
Spillway Crest	270
Normal Pool	270
Reservoir Drain Outlet	260
Streambed at Downstream Toe	±260
Crest of Adjacent Roadway (Auxiliary Spillway)	272

d. Reservoir Length (Feet).

Normal Pool, El. 270	2,500
Top of Dam, El. 279	4,000

e. Reservoir Storage (Acre Feet)

Normal Pool, El. 270	40
Top of Dam, El. 279	236

f. Reservoir Surface Area (Acres).

Normal Pool, El. 270	11.9
Top of Dam, El. 279	34.2

g. Dam Data.

Type	Concrete Capped, Rockfilled Timber Crib
Length	189 Feet
Height (Above Streambed)	19 Feet
Crest Width	10 Feet

Side Slopes (Upstream)	Vertical
(Downstream)	5H:1V & Vertical
Cut-off	Steel Sheet Piling
Foundation Treatment	None
Grout Curtain	None

h. Spillway.

Type	Free Overflow
Length	150 Feet
Elevation of Crest	270
Discharge Channel	Natural downstream creek channel

i. Auxiliary Spillway.

Type	Paved Roadway
Length	30 Feet
Elevation of Crest	272
Discharge Channel	Normal flows would return to creek

j. Outlet Works.

Type	36-inch diameter corrugated metal pipe
Control Location	Control gate located at intake

SECTION 2

ENGINEERING DATA

2.1 Design

a. Data Available. A summary of engineering data available for Camp Delmont Dam is included as Appendix B of this report.

No design or "as built" drawings are available.

b. Design Features. A description of design features is included in Section 1.2a and a summary of the pertinent features is included in Section 1.3.

2.2 Construction

Documented information available relative to construction of the dam consists of a correspondence file provided by the Pennsylvania DER. Periodical inspection reports included in the file relate only to percent completion of the project work items.

2.3 Operation

According to the Owner's representative, no reservoir stage or rainfall records are maintained and no operating procedures exist for the dam. However, the stage during Tropical Storm Agnes (1972) was reported to be about 6 feet above the spillway crest.

2.4 Evaluation

a. Availability. Information was obtained from the files of the Pennsylvania the Pennsylvania DER and supplemented by discussions with the Owner's representative during and after the inspection.

b. Adequacy. The information made available by the Pennsylvania DER, conversations with the Owner's representative and observations made during the field inspection provided adequate data for a Phase I evaluation.

c. Validity. The available information from the above sources appears to be valid.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Camp Delmont Dam took place on December 18, 1980. The observations and comments of the field inspection team are presented in Appendix A of this report. At the time of the inspection, the water surface was approximately 0.1 feet above the spillway crest. Because of the discharge conditions at the time of the inspection, a complete visual inspection of the spillway portion of the dam could not be made. No underwater areas were inspected.

b. Dam. The horizontal and vertical alignment of the dam appears to be good. No significant settlement or displacement of the concrete slabs was noted. The concrete cap over the rockfilled timber crib spillway portion of the dam appears to in good condition. The steel sheeting on the upstream face of the spillway portion of the dam was not visible at the time of inspection, since it is below the normal reservoir level.

The abutments of the dam appear to be in good condition. Evidence of major repairs made after the initial construction were observed. The abutments are protected with concrete slabs. A length of the horizontal timber planking on the downstream face of the spillway portion of the dam has been displaced.

c. Appurtenant Structures. The discharge end of the reservoir drain pipe was noted in the downstream face of the dam. No discharge through the pipe was evident at the time of the inspection. The reservoir drain gate stem is visible in the impoundment. The road adjacent to the left abutment is 7 feet lower than the crest of the left abutment. Based on a review of available correspondence, it appears that the roadway was to be raised in elevation to at least equal the top of dam elevation. This modification was not made. Access to the dam along the roadway during floods would not be possible. Evidence of erosion around the left abutment was noted. However, the erosion is minimal and appears to be due to foot traffic.

d. Reservoir Area. The banks adjacent to the reservoir are wooded. No indications of slope instability were noted. The impoundment appears to be silted in the immediate vicinity of the spillway.

e. Downstream Channel. The channel immediately downstream of the dam is covered with large boulders and the overbanks consist of earth with some rock outcrops. A 7-foot high rock dam (run-of-the-river) is located about 0.3 miles downstream of Camp Delmont Dam.

3.2 Evaluation

Based on visual observations, the dam and appurtenances appear to be in good condition except for the missing planking on the downstream face of the spillway portion of the dam. The condition of the reservoir drain gate could not be verified during the inspection.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Procedures

Under normal operating procedures, water is discharged over the spillway. The reservoir is frequently drained to remove and replace a dock and for the removal of sediment and vegetative growth in the reservoir.

4.2 Maintenance of the Dam

According to the Owner's representative, no regular maintenance program exists for the dam. Accumulations of debris are removed from the spillway as required.

4.3 Maintenance of Operating Facilities

According to the Owner's representative, no regular maintenance program exists for the operating facilities.

4.4 Description of any Warning Systems in Effect

According to the Owner's representative, no written warning system or procedures are established for monitoring the structure during periods of heavy rainfall or in the event of impending dam failure. However, the dam is monitored during large storms by Camp Delmont personnel. In the event of impending failure, the Marlboro Township Fire-Rescue unit would be notified.

4.5 Evaluation

A formal maintenance program for the dam and appurtenances should be developed and implemented. Records of all maintenance performed should be maintained by the Owner.

Periodic inspection of the dam and appurtenances should be made by a qualified engineer. The control valve should be opened for his inspection. Maintenance records should also be reviewed by the engineer.

A written warning system should be developed and implemented.

SECTION 5

HYDROLOGY AND HYDRAULICS

5.1 Evaluation of Features

a. Design Data. Design information relative to the dam is limited to information provided in the application for construction.

The drainage area is 34.9 square miles. According to the application, several dams were upstream of the proposed dam. The largest was located about 1.1 miles upstream and was reported to be 12 feet high. This structure no longer exists. The area of the proposed impoundment was estimated to be 13 acres.

The spillway was estimated to be 150 feet long. The design discharge head is 8.5 feet. The spillway was designed for a capacity of 13,000 cfs.

Based on a review of available topographic maps, the watershed has a maximum length of about 16 miles and a maximum width of about 6 miles. The ground surface ranges from approximately El. 580 to normal pool El. 270. The planimetered drainage area of 34.9 square miles is essentially rural with forests, pasture, farmland and a limited amount of residential, commercial and industrial development.

b. Experience Data. According to the Owner's representative, no rainfall or spillway discharge records are maintained. However, it was reported that the reservoir stage during Tropical Storm Agnes (June 1972) was about 6 feet above the spillway crest. Based on the appearance of the roadway (paved) and the overbank adjacent to the left abutment, this area would provide additional discharge capacity and act as an auxiliary spillway.

c. Visual Observations. Nothing was observed during the inspection that would indicate the spillway would not perform as designed. The roadway would also provide additional spillway capacity.

d. Overtopping Potential. Camp Delmont Dam is classified as a "Small" size "Significant" hazard dam. According to the Guidelines, the recommended Spillway Design Flood (SDF) ranges from the one-hundred year to fifty percent of the Probable Maximum Flood (PMF). Because of several inhabitable dwellings located downstream of the dam, fifty percent of the PMF was selected as the appropriate SDF.

The SDF was routed through Camp Delmont Dam using the HEC-1 DB computer program with the starting water surface elevation at the spillway crest, elevation 270. A brief description of the program is included in Appendix D. The peak inflow and outflow rates for the SDF are about 23,550 cfs. The maximum reservoir stage for this event is about 1.5 feet above the top of the dam and the duration of overtopping is 5.5 hours. The spillway and roadway adjacent to the left abutment are capable of discharging about 36 percent of the PMF before over-

topping the abutments. The spillway is capable of discharging about 26 percent of PMF before overtopping the abutments.

The one-hundred year flood event was developed and routed through Camp Delmont Dam using the HEC-1 DB Computer program with the starting water surface elevation at the spillway crest. The peak inflow and outflow rates for the one-hundred year flood are 11,809 and 11,750 cfs respectively. The maximum reservoir stage during this event is 277.4. The spillway and roadway are capable of discharging the one-hundred year flood event without overtopping the dam.

e. Spillway Adequacy. Since the Camp Delmont Dam spillway and adjacent roadway are incapable of passing the SDF, the spillway system is classified as "Inadequate".

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observation. The horizontal and vertical alignments of the dam appear to be satisfactory. The concrete surfaces of the spillway slabs appear to be in good condition. A section of the horizontal planking on the downstream face of the overflow section has been displaced. The portions of the steel and timber sheet pile which are visible appear to be in satisfactory condition. Recent repairs have been made to both of the abutment sections.

Based upon the visual observations, the dam appears to be stable for normal loading conditions.

b. Design and Construction Data. Limited design and construction data is available. No design drawings are available. Based on measurements made in the field, the dam has been constructed in general conformance with information provided in the Report Upon the Application.

c. Operating Records. According to the Owner's representative, no operating records are available.

d. Post-Construction Changes. No records exist of post-construction changes. No visible evidence of post-construction changes are apparent.

e. Seismic Stability. Camp Delmont Dam is located in Seismic Zone 1 on the Seismic Zone Map of Contiguous States. A dam located in Seismic Zone 1 is generally considered to be safe under any expected Zone 1 earthquake loading conditions if it is stable under static loading conditions.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Evaluation. Based on visual observations, the dam and appurtenances appear to be in good condition except for a length of horizontal planking on the downstream face of the dam which has been displaced.

The control valve for the reservoir drain was not operated during the inspection. It is not known if the valve is operable.

The spillway and roadway are capable of discharging approximately 36 percent of the PMF prior to overtopping the dam. The selected SDF of 50 percent of the PMF would overtop the dam by a maximum of 1.5 feet for about 5.5 hours. Since the spillway is not capable of passing the SDF, the spillway is classified as "Inadequate". Further examination of the hydrologic and hydraulic analyses indicates that the spillway and adjacent roadway are capable of passing the one-hundred year event without overtopping the dam abutments.

b. Adequacy of Information. The information available from the Pennsylvania DER, visual observations, and discussions with the Owner's representative are considered adequate for a Phase I investigation.

c. Urgency. The remedial measures recommended in Section 7.2 should be effected immediately.

d. Necessity for Further Investigation. Further investigations should be implemented as discussed in Section 7.2a.

7.2 Recommendations and Remedial Measures

The Owner should immediately initiate he following recommendations and remedial procedures.

a. Facilities.

1. The displaced portion of the horizontal planking on the downstream face of the overflow section should be replaced.

2. The control valve for the reservoir drain should be exercised and repaired if necessary.

b. Operation and Maintenance

1. A formal inspection and maintenance program should be developed and implemented to insure that the dam and appurtenances are maintained on a regularly scheduled basis. Maintenance performed should be recorded to provide a history of corrected deficiencies.

2. A formal downstream warning system should be developed. During periods of heavy rainfall, the dam should be monitored and appropriate agencies should be alerted in the event of an impending failure.

APPENDIX A

CHECKLIST
VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam Camp Delmont Dam County Montgomery State Pennsylvania National ID # PA 00938

Type of Dam Rock filled timber Crib Hazard Category Significant

Date(s) Inspection 12/18/80 Weather Partly Cloudy Temperature 30°

Pool Elevation at Time of Inspection ±270 M.S.L. Tailwater at Time of Inspection ±261 M.S.L.

Inspection Personnel:

L. H. DeHeer L. R. Beck J. Rauschkolb

Richard Beck

L.H. DeHeer Recorder

Remarks:

The inspection team was accompanied by Mr. Charles Vargason representing the Owner, Boy Scouts of America, Valley Forge Council.

Sheet 1 of 11

CONCRETE CAPPED ROCK-FILLED TIMBER CRIB

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	The structure is a run-of-the-river dam constructed as a rock-filled timber crib and capped with concrete. Seepage through the structure is tolerable.	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	No seepage or erosion was observed.	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	Not observed.	

Sheet 2 of 11

CONCRETE CAPPED ROCK-FILLED TIMBER CRIB

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	No significant cracking was noted in the concrete surfaces. A portion of the vertical timber planking located at the downstream face of the left non-overflow section appears to be loose.	Repair the planking.
STRUCTURAL CRACKING	No structural cracking was noted.	
VERTICAL AND HORIZONTAL ALIGNMENT	The vertical and horizontal alignment of the dam appears to be good.	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	No significant relative movement was noted at the construction joints.	

Sheet 3 of 11

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	N/A	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	N/A	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	N /A	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	N/A	
RIPRAP FAILURES	N /A	

Sheet 4 of 11

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	N/A	
ANY NOTICEABLE SEEPAGE	N/A	
STAFF GAGE AND RECORDER	N/A	
DRAINS	N/A	

Sheet 5 of 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE	Gate valve is reportedly mounted on upstream vertical steel sheet pile wall of the overflow portion of dam which could not be observed during the inspection.	
OUTLET STRUCTURE	Outlet works pipe outlets at the downstream vertical portion of the overflow section.	
OUTLET CHANNEL	The outlet channel is the natural boulder strewn channel.	
EMERGENCY GATE	Intake structure described above Access would be almost impossible during high discharges.	

Sheet 6 of 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	
INTAKE STRUCTURE	Gate valve is reportedly mounted on upstream vertical steel sheet pile wall of the overflow portion of dam which could not be observed during the inspection.	
OUTLET STRUCTURE	Outlet works pipe outlets at the downstream vertical portion of the overflow section.	
OUTLET CHANNEL	The outlet channel is the natural boulder strewn channel.	
EMERGENCY GATE	Intake structure described above Access would be almost impossible during high discharges.	

Sheet 6 of 11

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The concrete surfaces appear to be in satisfactory condition.	
APPROACH CHANNEL	The impoundment is the approach channel.	
DISCHARGE CHANNEL	The discharge channel is the natural stream. The channel is littered with large boulders downstream of the dam. The overbank area is unprotected earth in many areas.	
BRIDGE AND PIERS	N/A	

Sheet 7 of 11

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	N/A	
DISCHARGE CHANNEL	N/A	
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

Sheet 8 of 11

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	

Sheet 9 of 11

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes to the reservoir are moderate and appear to be stable.	
SEDIMENTATION	The level of sedimentation appears to be high in the immediate area of the dam.	

Sheet 10 of 11

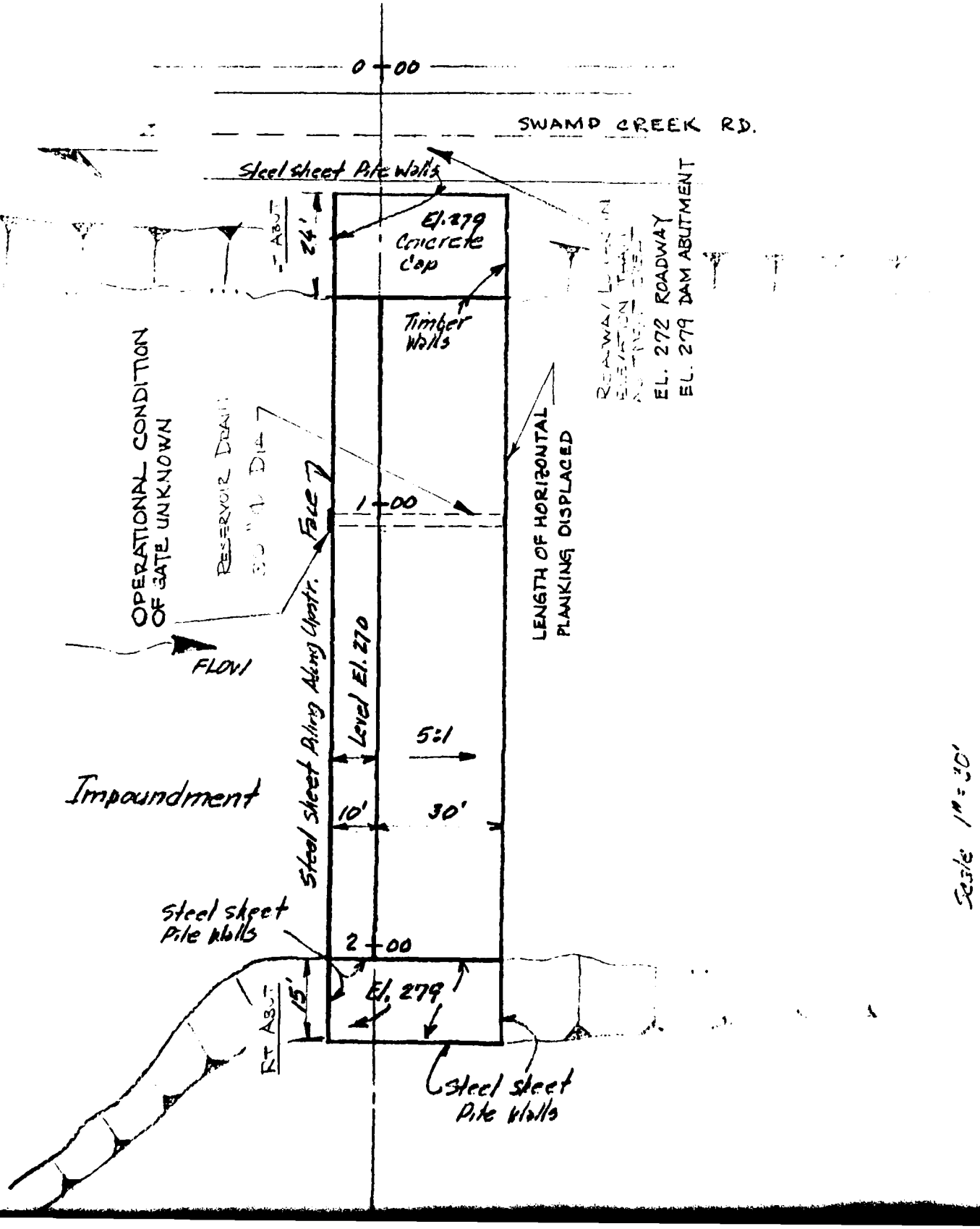
DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The channel is littered with large boulders. A small rock-filled run of the river dam is located about 1,500 feet downstream of Camp Delmont Dam.	
SLOPES	The overbanks are wooded. The banks are moderate to steeply sloped. The slope of the invert of the creek downstream of Camp Delmont Dam averaging about one percent.	
APPROXIMATE NO. OF HOMES AND POPULATION	A number of cottages (approximately 7) are located one half mile downstream of the dam. Approximately 30 to 40 people would be involved.	

Sheet 11 of 11

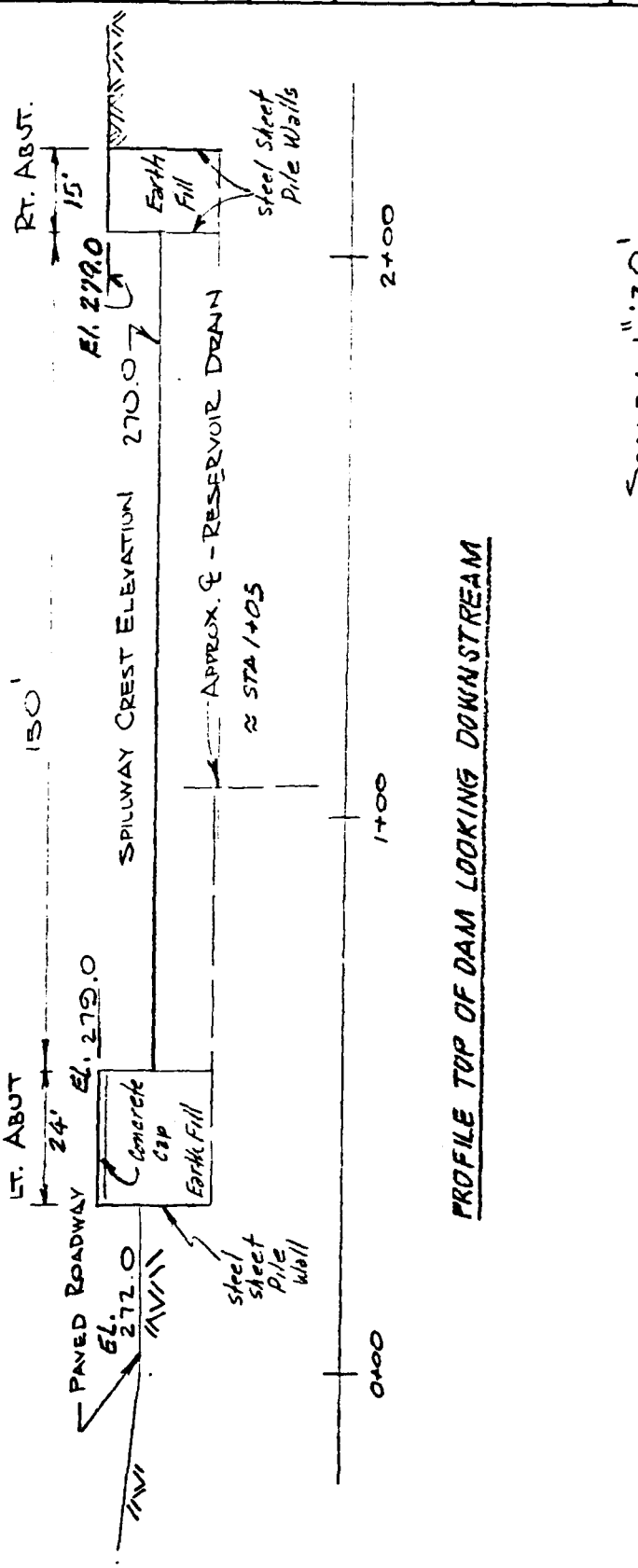
O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO.
[illegible]	11A			



O'BRIEN & GERE ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	11B	REH	3/3/81	1841 014.111



PROFILE TOP OF DAM LOOKING DOWNSTREAM

SCALE: 1" : 30'

APPENDIX B

CHECKLIST
ENGINEERING DATA

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Camp Delmont Dam

ID # PA 00938

ITEM	REMARKS
AS-BUILT DRAWINGS	No "as built" drawings are available.
REGIONAL VICINITY MAP	Refer to Appendix E, Figure 1
CONSTRUCTION HISTORY	Construction history is limited to a correspondence file initiated by the State in 1947.
TYPICAL SECTIONS OF DAM	No design drawings are available. For plan and section sketches prepared for this report refer to sheet 3 & 4, Appendix E.
OUTLETS - PLAN	No drawings are available.
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	None available.
RAINFALL/RESERVOIR RECORDS	Rainfall/reservoir records are not available.

Sheet 1 of 4

ITEM	REMARKS
DESIGN REPORTS	None available.
GEOLOGY REPORTS	None available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None available.
POST-CONSTRUCTION SURVEYS OF DAM	None available.
BORROW SOURCES	No information available.

Sheet 2 of 4

ITEM	REMARKS
MONITORING SYSTEMS	None known of.
MODIFICATIONS	None known of.
HIGH POOL RECORDS	Records are not maintained.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None known of.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None known of.
MAINTENANCE OPERATION RECORDS	None available.

Sheet 3 of 4

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	None available.
OPERATING EQUIPMENT PLANS & DETAILS	None available.
MISCELLANEOUS	

Sheet 4 of 4

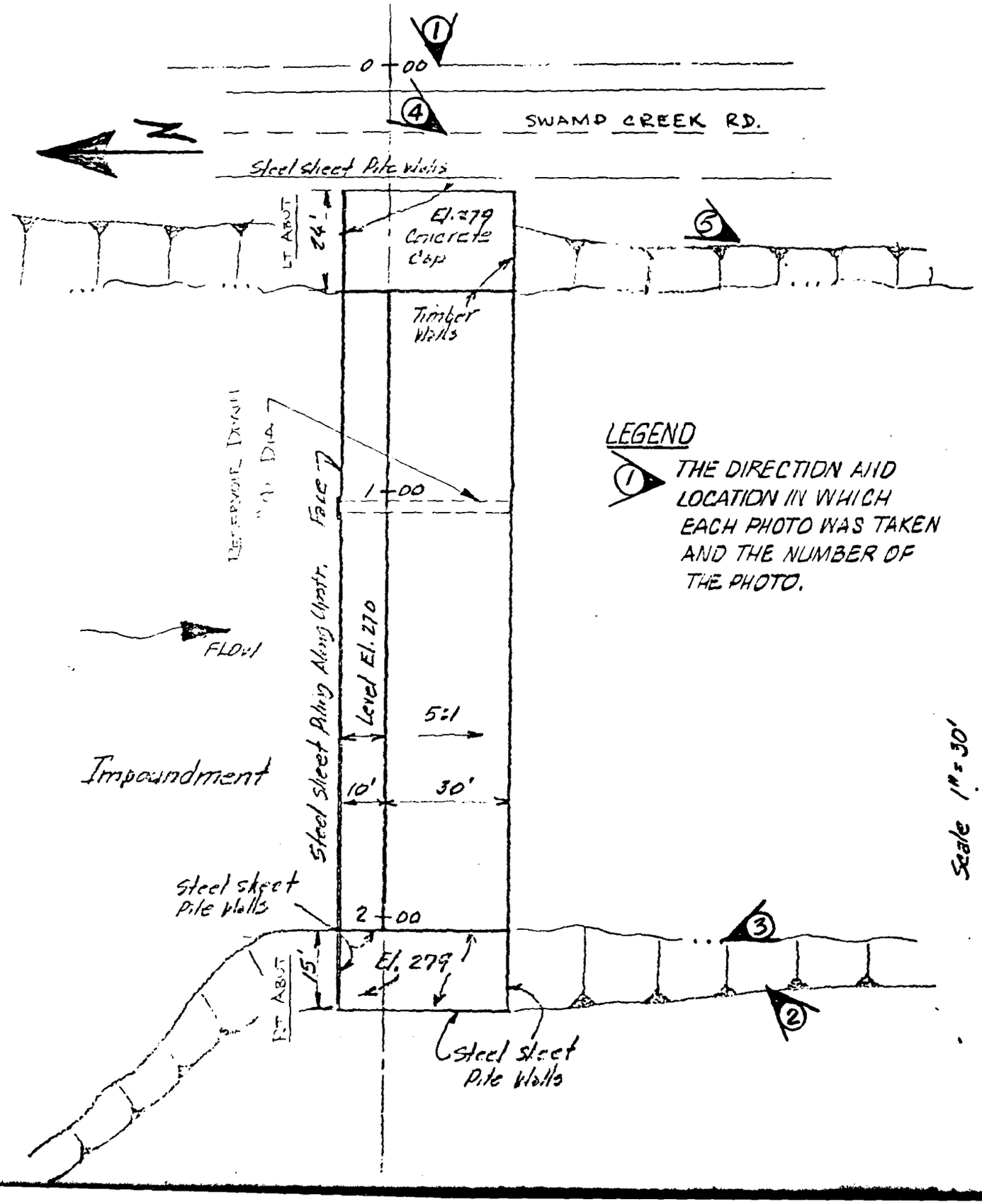
APPENDIX C

PHOTOGRAPHS

APPENDIX C
PHOTOGRAPH TABLE OF CONTENTS

O'BRIEN & GERE
ENGINEERS, INC

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	A	REH	2/5/81	1841.014.111



1. VIEW ALONG THE AXIS OF THE DAM FROM THE LEFT ABUTMENT. (12/19/80)

2. LEFT SIDE OF THE DAM AND CHANNEL CONDITIONS IMMEDIATELY DOWNSTREAM OF THE DAM. (12/19/80)

3. RIGHT SIDE OF THE DAM AND CHANNEL CONDITIONS IMMEDIATELY DOWNSTREAM OF THE DAM. (12/19/80)

4. LOOKING DOWNSTREAM ALONG THE ROAD ON THE LEFT ABUTMENT WHICH ACTS AS AN AUXILARY SPILLWAY. (12/19/80)

5. TYPICAL DOWNSTREAM CHANNEL CONDITIONS. (12/19/80)

6. DAM ABOUT 1.5 MILES UPSTREAM OF CAMP DELMONT DAM. (12/19/80)

7. DAM ABOUT 1,500 FEET DOWNSTREAM OF CAMP DELMONT DAM. (12/19/80)

8. INITIAL POTENTIAL DAMAGE AREA ABOUT 2,000 FEET DOWNSTREAM OF CAMP DELMONT DAM. (12/19/80)

9. POTENTIAL DAMAGE AREA ABOUT 5,000 FEET DOWNSTREAM OF CAMP DELMONT DAM. (12/19/80)

10. BRIDGE WHICH WOULD RESTRICT FLOW ABOUT 5,500 FEET DOWNSTREAM OF THE DAM. (12/19/80)

APPENDIX D

HYDROLOGIC AND HYDRAULIC ENGINEERING DATA

CAMP DELMONT DAM
APPENDIX D
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

TABLE OF CONTENTS

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: Rural, open pasture & farmland

* ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 270 (40 Acre-Feet)

* ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

* ELEVATION MAXIMUM DESIGN POOL: N/A

* ELEVATION TOP DAM (STORAGE CAPACITY): 279 (236 Acre-Feet)

SPILLWAY

a. *Elevation 270

b. Type Concrete Weir

c. Width 150 feet

d. Length 40 feet

e. Location Spillover Center of Dam

f. Number and Type of Gates None

OUTLET WORKS:

a. Type 36 inch diameter CMP

b. Location Approx 100 feet from Right Abutment

c. Entrance inverts ≈ *El 260

d. Exit inverts ≈ *El 260

e. Emergency draindown facilities 36-inch diameter control valve at intake. Operational condition unknown.

HYDROMETEOROLOGICAL GAGES:

a. Type None within Watershed

b. Location N/A

c. Records N/A

MAXIMUM NON-DAMAGING DISCHARGE: Not known

* Elevations estimated from USGS quad. All elevations are in feet, mean sea level.

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed [1]

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out.

[1] "High" hazard structures only

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	3	REH	3/4/81	1841-014
		✓	3/16/81	

Hydrology

- Drainage Area - 34.9 square miles (planimeter from U.S.G.S. Quad Sheets.)

- Design Flood:

  Size Classification - Small
  Hazard Classification - SIGNIFICANT

  Use PMF

- PMP Determination (HR #33)

  Camp Delmont Dam is located in Zone Number 6

  PMP = 23.5" (200 square miles, 24 hours)

Time (Hrs)	Percent	Rainfall (inches)
6	100	23.5
12	110	25.9
24	120	28.2
48	132	31.0

- Snyder Coefficients (Provided by Balt. Dist. COE)

  Camp Delmont Dam is located in Zone Number 7

  C_t = 1.35
  C_p = 0.65

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	4	REH	3/4/81	1841-014

✓ 3/6/81

Hydrology Cont

$$t_p = C_c (L \cdot L_{CA})^{.3}$$

$L \approx 84{,}000$ ft $=$ 15.9 miles
$L_{CA} \approx 42{,}000$ ft $=$ 7.9 miles

$$t_p = 1.35 (15.9 \times 7.9)^{.3} = 5.75 \text{ hrs}$$

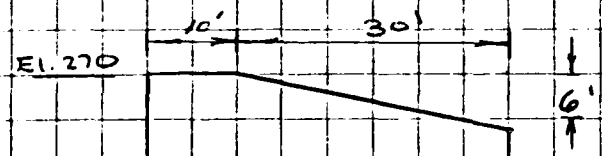
Hydraulics

- Stage / storage

Stage	Surface Area (Ac)	
270 (estimated)	11.9	(normal pool)
280	36.7	

- Stage / Discharge

Overflow Spillway $Q = CLH^{3/2}$ $L = 150'$



Approx Crest Shape use $C = 3.1$

O'BRIEN & GERE

SUBJECT	SHEET REVISED	BY	DATE	JOB NO
CAMP DELMONT DAM	5	REH	5/15/81	1841.01d

Rating for Overflow Spillway

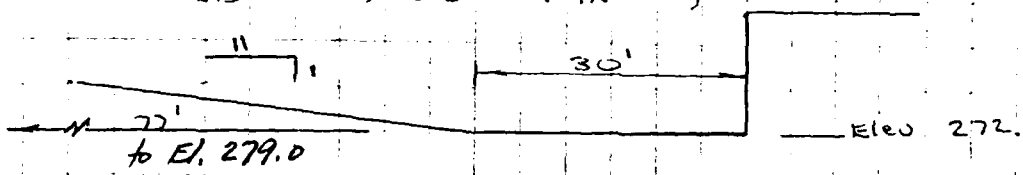
Stage	Head (ft)	Discharge (cfs)
270	0	0
272	2	1,315
274	4	3,720
276	6	6,834
278	8	10,522
280	10	14,705
282	12	19,330
284	14	24,358

Note: Velocity head assumed to be negligible

Roadway Adjacent to Left Abutment and Abutment

$$Q = \underset{\text{(Abutments)}}{3(39)H_{279}^{3/2}} + \underset{\text{(Road)}}{2.7(30)H_{272}^{3/2}} + \underset{\text{(Slope)}}{2.7(L_1)(.83H)^{3/2}} \quad *$$

Total length, both abutments = 39'



* Ref: Pg 14-, NEH-4, SCS

Rating for Abutments, Road and Slope

Stage	Head (ft)	L_1 (ft)	Q_{ABUT}	Q_{ROAD}	Q_{SLOPE}	Q_{TOTAL}
272	0	0	0	0	0	0
274	2	18	0	229	104	333
276	4	36	0	648	588	1236
278	6	54	0	1190	1620	2810
280	8	72	117	1833	3326	5276
282	10	90	607	2561	5810	8978
284	12	108	1308	3367	9166	13841

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	Revised 6	REH	5/15/81	1841.014

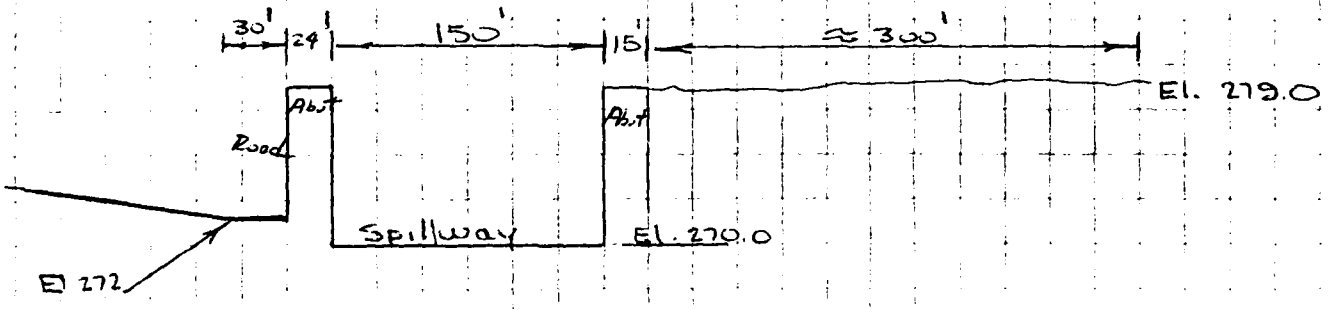
Stage - Discharge - Summary

Stage	Discharge (cfs)
270	0
272	1,315
274	4,053
276	8,070
278	13,332
280	19,981
282	28,308
284	38,199

For Overtopping (reservoir stage > 279)

use L = 300 feet (estimated from USGS Quad Sheet)

C = 2.7 for overtopping



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1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  01 APR 80
 **********
     1                A1                        HYDROLOGIC ANALYSIS OF CAMP DELMONT DAM
     2                A2                            NATIONAL DAM SAFETY PROGRAM
     3                A3                        BALTIMORE DIVISION - CORPS OF ENGINEERS
     4                B    300       0      10       0       0       0       0       0      -4       0
     5                B1     5
     6                J      1       4       1
     7                J1    .3      .4      .5     1.0
     8                K      0    LAKE       0       0       0       0       1
     9                K1                                INFLOW TO LAKE
    10                M      1       1    34.9                                                       1
    11                P      0    23.5     100     110     120     130
    12                T                                                               1.0     .05
    13                W   5.75     .65
    14                X   -1.5    -.05       2
    15                K      1     DAM       0       0       0       0       1
    16                K1                                OUTFLOW FROM DAM
    17                Y                                 1       1
    18                Y1     1                                                       -270      -1
    19                Y4   270     272     274     276     278     280     282     284
    20                Y5     0    1315    4053    8070   13332   19981   28308   38199
    21                $A     0    11.9    36.7     105
    22                $E   260     270     280     300
    23                $$   270
    24                $D   279     2.7     1.5     300
    25                K     99

1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                                  RUNOFF HYDROGRAPH AT        LAKE
                                  ROUTE HYDROGRAPH TO          DAM
                                  END OF NETWORK
```

54 7

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1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  01 APR 80
**********

RUN  DATE* 81/05/15.
     TIME* 10.30.24.
```

HYDROLOGIC ANALYSIS OF CAMP DELMONT DAM
NATIONAL DAM SAFETY PROGRAM
BALTIMORE DIVISION _ CORPS OF ENGINEERS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	10	0	0	0	0	0	-4	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1

RTIOS= .30 .40 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW TO LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	34.90	0.00	34.90	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	100.00	110.00	120.00	130.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .840

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA

TP= 5.75 CP= .65 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH100 END-OF-PERIOD ORDINATES, LAG= 5.71 HOURS, CP= .65 VOL= .93

14.	52.	108.	175.	251.	334.	423.	518.	617.	719.
826.	934.	1046.	1159.	1275.	1392.	1510.	1630.	1750.	1867.
1977.	2079.	2171.	2256.	2332.	2400.	2460.	2512.	2555.	2591.
2617.	2635.	2644.	2644.	2633.	2610.	2572.	2511.	2433.	2353.
2276.	2201.	2129.	2060.	1992.	1927.	1864.	1803.	1744.	1687.
1631.	1578.	1526.	1476.	1428.	1381.	1336.	1292.	1250.	1209.
1169.	1131.	1094.	1058.	1023.	990.	957.	926.	896.	866.
838.	810.	784.	758.	733.	709.	686.	664.	642.	621.
601.	581.	562.	543.	526.	508.	492.	476.	460.	445.
430.	416.	403.	390.	377.	364.	352.	341.	330.	319.

0 END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	25.65	23.23	2.43	2422604.
										(652.)	(590.)	(62.)	(68600.51)

S16 9

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

OUTFLOW FROM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-270.	-1

STAGE	270.00	272.00	274.00	276.00	278.00	280.00	282.00	284.00
FLOW	0.00	1315.00	4053.00	8070.00	13332.00	19981.00	28308.00	38199.00
SURFACE AREA=	0.	12.	37.	105.				
CAPACITY=	0.	40.	271.	1630.				
ELEVATION=	260.	270.	280.	300.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
279.0	2.7	1.5	300.

PEAK OUTFLOW IS 14113. AT TIME 45.00 HOURS

PEAK OUTFLOW IS 18818. AT TIME 45.00 HOURS

PEAK OUTFLOW IS 23524. AT TIME 45.00 HOURS

PEAK OUTFLOW IS 47049. AT TIME 44.83 HOURS

Sh 10

1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY F 4ULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .30	RATIO 2 .40	RATIO 3 .50	RATIO 4 1.00
HYDROGRAPH AT	LAKE	34.90	1	14122.	18830.	23537.	47075.
		(90.39)		(399.90)(533.20)(666.50)(1333.00)(			
ROUTED TO	DAM	34.90	1	14113.	18818.	23524.	47049.
		(90.39)		(399.63)(532.87)(666.12)(1332.28)(			

1 SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	270.00	270.00	279.00
STORAGE	40.	40.	236.
OUTFLOW	0.	0.	16657.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.30	278.23	0.00	211.	14113.	0.00	45.00	0.00
.40	279.55	.55	255.	18818.	3.17	45.00	0.00
.50	280.50	1.50	290.	23524.	5.67	45.00	0.00
1.00	283.97	4.97	438.	47049.	9.50	44.83	0.00

SK 11

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	12	JFR	4-23-81	1841-014

SCS LAG TIME

$$\text{AVG. BASIN SLOPE} = \frac{\Delta EL.}{L} = \frac{580 - 270}{65{,}600} = 0.005 \frac{FT}{FT}$$

Assume trapezoidal channel section, 4-ft depth, top width 50-ft, side slopes 2H:1V.

$$V = \frac{1.49}{n} R^{2/3} S^{1/2}$$

$$= \frac{1.49}{.06} \left(\frac{168}{51.9}\right)^{2/3} (.005)^{1/2}$$

$$= 3.86 \text{ fps}$$

$$T_c = \frac{65{,}600}{3.86} = 16{,}995 \text{ sec.} = 4.72 \text{ hrs.}$$

$$L = 0.6\, T_c = 0.6\,(4.72) = 2.83 \text{ hrs.}$$

$$T_p = \frac{D}{2} + L = \frac{.133\, T_c}{2} + L$$

$$= \frac{.133\,(4.72)}{2} + 2.83$$

$$= 3.14 \text{ hrs.}$$

Where T_c = Time of Concentration

L = Basin Lag Time

T_p = Time to Peak

D = Duration of Rainfall

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	13	JFR	4-15-81	1841-014-111

ONE HUNDRED YEAR STORM DEVELOPMENT

RAINFALL FOR 100 YEAR RETURN *

DURATION	RAINFALL
30 MIN.	2.4"
1 HR.	3.2"
2 HR.	3.9"
3 HR.	4.3"
6 HR.	5.2"
12 HR.	6.2"
24 HR.	7.2"

* FROM TP-40, U.S. WEATHER BUREAU

THE FOLLOWING HYPOTHETICAL HYETOGRAPH WAS DEVELOPED USING THE SCS METHOD OF RAINFALL DISTRIBUTION. DATA FOR THE STORM WAS AQUIRED FROM AN ACCUMULATED RAINFALL-DURATION CURVE. THE 24-HOUR MASS CURVE WAS DIVIDED INTO 15 MINUTE INTERVALS TO OBTAIN THE CORRESPONDING RAINFALL INCREMENTS.

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	14	JFR	4-15-81	1841-014-111

100 YR. STORM DISTRIBUTION

TIME INTERVAL (HOURS) FROM	TO	RAINFALL INCREMENT (INCHES)	NUMBER OF INCREMENTS
0	4 3/4	.02	19
4 3/4	7 1/4	.03	10
7 1/4	8	.04	3
8	9	.05	4
9	9 1/2	.06	2
9 1/2	10	.07	2
10	10 1/2	.08	2
10 1/2	10 3/4	.10	1
10 3/4	11	.12	1
11	11 1/4	.14	1
11 1/4	11 1/2	.20	1
11 1/2	11 3/4	.34	1
11 3/4	12	.90	1
12	12 1/4	1.50	1
12 1/4	12 1/2	.41	1
12 1/2	12 3/4	.20	1
12 3/4	13	.16	1
13	13 1/4	.13	1
13 1/4	13 1/2	.10	1
13 1/2	13 3/4	.09	1
13 3/4	14 1/4	.08	2
14 1/4	14 3/4	.07	2
14 3/4	15 1/4	.06	2
15 1/4	16	.05	3
16	17	.04	4
17	19 1/2	.03	10
19 1/2	24	.02	18
		7.20"	96

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	15	JFR	4-22-81	1814-014

KRV

PEAK INFLOW FOR 100 YR. FLOOD

Reference: Water Resources Bulletin No. 13, "Floods of Pennsylvania", October 1977.

Drainage basin is in Region 7.

Model 7A (Area > 15 sq. mi.):

$$Q_T = c A^x St^s$$

$$Q_{100} = 760\, A^{.692}\, St^{-.400}$$

$$St = 1.0 + 0.01 = 1.01$$

$$A = 34.9 \text{ sq. mi.}$$

$$Q_{100} = 760\,(34.9)^{.692}\,(1.01)^{-.400}$$

$$= 8845 \text{ cfs}$$

O'BRIEN & GERE

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	16	JFR	4-22-81	

PEAK INFLOW FOR 100 YR. FLOOD (CONT.)

Reference: Regional Frequency Study, Upper Delaware and Hudson Rivers, New York District, C.O.E., November 1974.

$$\log(Q_m) = C_m + 0.87 \log(A)$$

$$S = C_s - 0.05 \log(A)$$

$$\log(Q_{100}) = \log(Q_m) + K_S$$

$C_m = 2.0$ (Figure 2)

$C_s = 0.355$ (Figure 3)

$g = +0.4 \quad \therefore K = 2.615$

$S = 0.355 - 0.05 \log(34.9) = 0.278$ ✓

$\log(Q_m) = 2.0 + 0.87 \log(34.9) = 3.342$

$\log(Q_{100}) = 3.342 + 2.615(.278) = 4.069$ ✓

$Q_{100} = 11,721$ cfs > 8845 cfs

SCS Curve Number is determined by trial & error using HEC-1-DB. Resulting discharge must be within ±10% of $Q_{100} = 11,721$ cfs.

$CN = 64, \quad Q_{PEAK} = 11,809$

$\frac{11,809 - 11,721}{11,721} * 100 = 0.75\%$

```
1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  01 APR 80
 **********
     1                A1                    HYDROLOGIC ANALYSIS OF CAMP DELMONT DAM
     2                A2                         NATIONAL DAM SAFETY PROGRAM
     3                A3                    BALTIMORE DIVISION _ CORPS OF ENGINEERS
     4                B    300       0      15       0       0       0       0       0      -4       0
     5                B1     3
     6                K      0    LAKE       0       0       0       0       1
     7                K1                                INFLOW TO LAKE
     8                M      0       2    34.9                                                   1
     9                D     96       0
    10                D1   .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
    11                D1   .02     .02     .02     .02     .02     .02     .02     .02     .02     .03
    12                D1   .03     .03     .03     .03     .03     .03     .03     .03     .03     .04
    13                D1   .04     .04     .05     .05     .05     .05     .06     .06     .07     .07
    14                D1   .08     .08     .10     .12     .14     .20     .34     .90    1.50     .41
    15                D1   .20     .16     .13     .10     .09     .08     .08     .07     .07     .06
    16                D1   .06     .05     .05     .05     .04     .04     .04     .04     .03     .03
    17                D1   .03     .03     .03     .03     .03     .03     .03     .03     .02     .02
    18                D1   .02     .02     .02     .02     .02     .02     .02     .02     .02     .02
    19                D1   .02     .02     .02     .02     .02     .02
    20                T                                                      -1     -64
    21                W2          2.83
    22                X   -1.5    -.05       2
    23                K      1     DAM       0       0       0       0       1
    24                K1                                OUTFLOW FROM DAM
    25                Y                                 1       1
    26                Y1     1                                                -270      -1
    27                Y4   270     272     274     276     278     280     282     284
    28                Y5     0    1315    4053    8070   13332   19981   28308   38199
    29                $A     0    11.9    36.7     105
    30                $E   260     270     280     300
    31                $$   270
    32                $D   279     2.7     1.5     300
    33                K     99

 1                          PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

                            RUNOFF HYDROGRAPH AT       LAKE
                            ROUTE HYDROGRAPH TO        DAM
                            END OF NETWORK

1**********
 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION      JULY 1978
   LAST MODIFICATION  01 APR 80
 **********

 RUN  DATE* 81/05/18.
      TIME* 04.45.06.

                                HYDROLOGIC ANALYSIS OF CAMP DELMONT DAM
                                     NATIONAL DAM SAFETY PROGRAM
                                BALTIMORE DIVISION _ CORPS OF ENGINEERS

                                        JOB SPECIFICATION
                      NQ      NHR     NMIN     IDAY      IHR     IMIN    METRC     IPLT     IPRT    NSTAN
                     300        0       15        0        0        0        0        0       -4        0
                                        JOPER      NWT    LROPT    TRACE
                                            3        0        0        0
```

54 17

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SUB-AREA RUNOFF COMPUTATION

INFLOW TO LAKE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
LAKE	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	34.90	0.00	34.90	0.00	0.000	0	1	0

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-64.00	0.00	0.00

CURVE NO = -64.00 WETNESS = -1.00 EFFECT CN = 64.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= 2.83

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	7.20	3.15	4.05	289122.
										(183.)	(80.)	(103.)	(8187.02)

SH 18

********** ********** ********** ********** **********

HYDROGRAPH ROUTING

OUTFLOW FROM DAM

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
DAM	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-270.	-1

STAGE	270.00	272.00	274.00	276.00	278.00	280.00	282.00	284.00
FLOW	0.00	1315.00	4053.00	8070.00	13332.00	19981.00	28308.00	38199.00
SURFACE AREA=	0.	12.	37.	105.				
CAPACITY=	0.	40.	271.	1630.				
ELEVATION=	260.	270.	280.	300.				

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
270.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	*COQD*	*EXPD*	*DAMWID*
279.0	2.7	1.5	300.

PEAK OUTFLOW IS 11749. AT TIME 15.50 HOURS

********** ********** ********** ********** **********

1

RUNOFF SUMMARY, AVERAGE FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES(SQUARE KILOMETERS)

		PEAK	6-HOUR	24-HOUR	72-HOUR	AREA
HYDROGRAPH AT	LAKE	11809.	8353.	2993.	1004.	34.90
		(334.41)(	236.54)(	84.74)(	28.43)(	90.39)
ROUTED TO	DAM	11749.	8339.	2993.	1004.	34.90
		(332.70)(	236.14)(	84.74)(	28.43)(	90.39)

1

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	270.00	270.00	279.00
STORAGE	40.	40.	236.
OUTFLOW	0.	0.	16657.

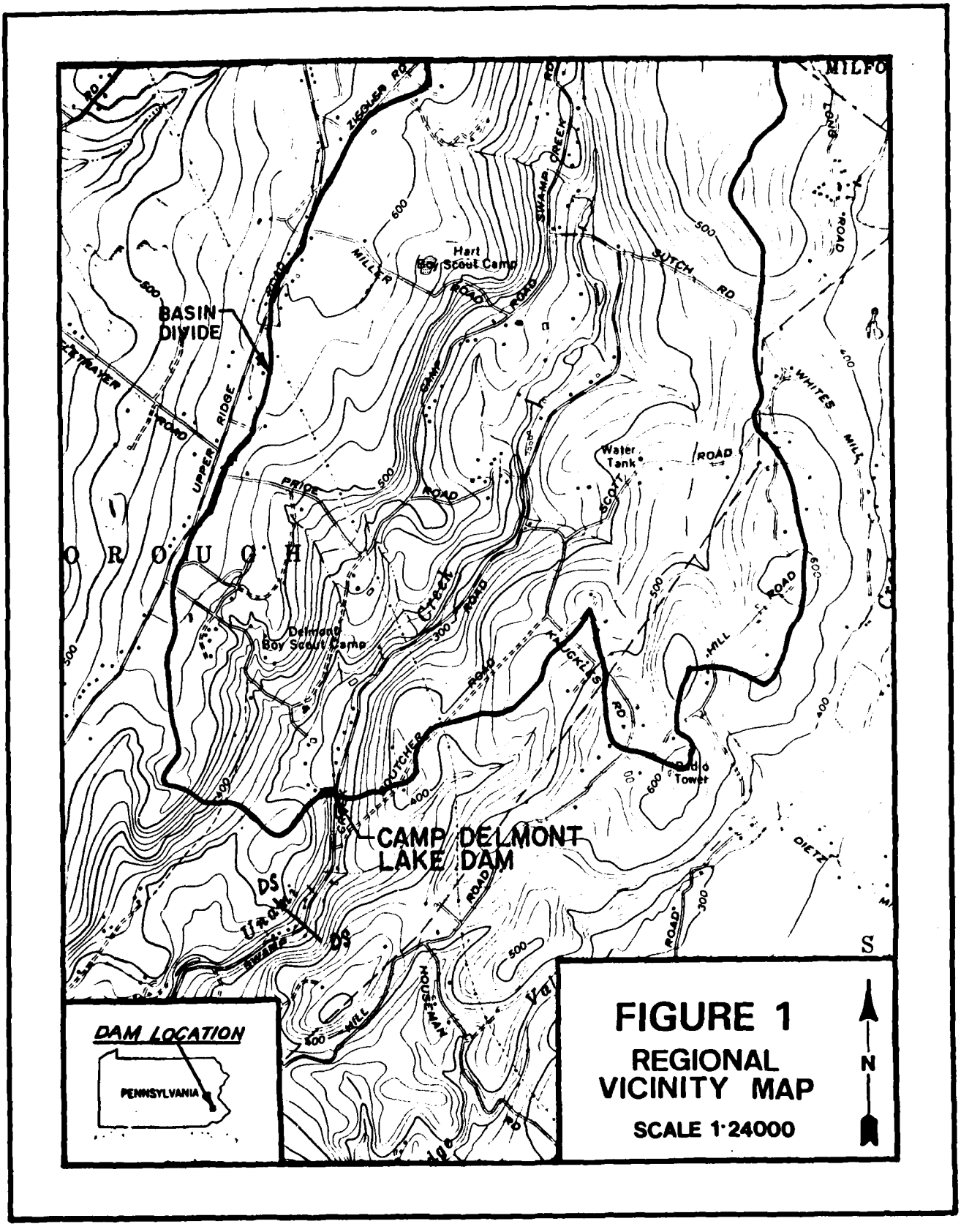
RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	277.40	0.00	186.	11749.	0.00	15.50	0.00

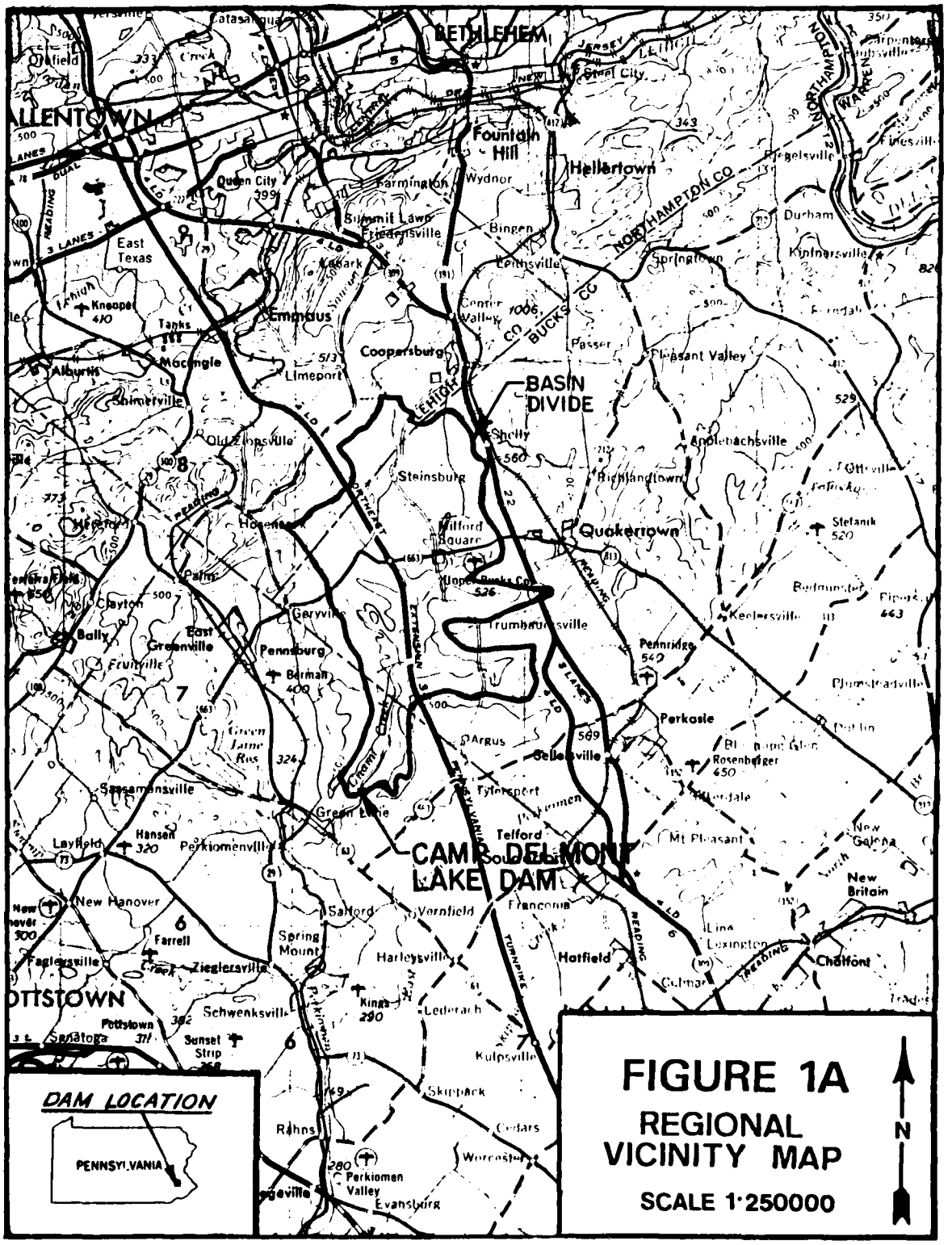
6/45

APPENDIX E

REGIONAL VICINITY MAP
&
DRAWINGS

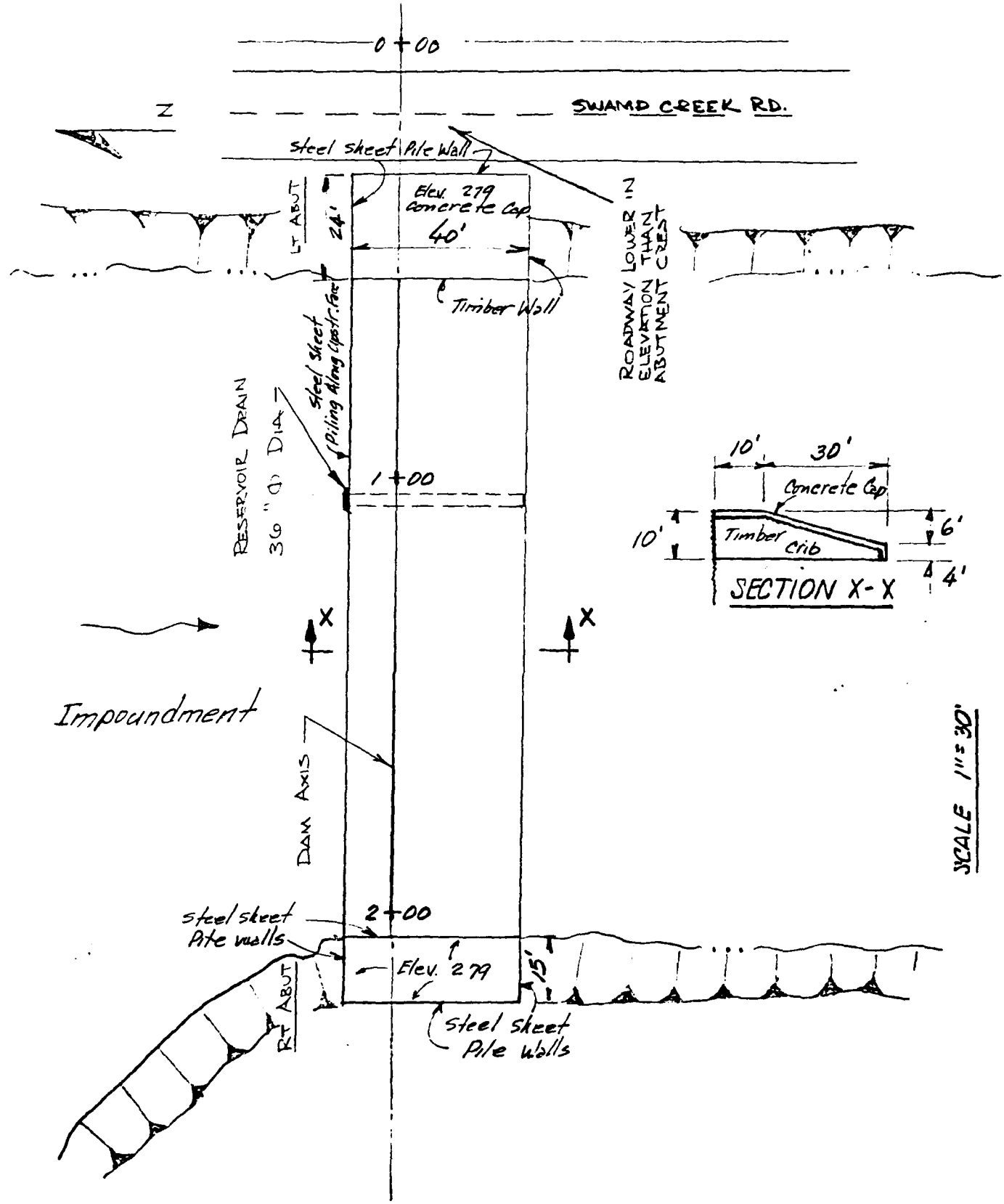
CAMP DELMONT DAM
APPENDIX E
REGIONAL VICINITY MAPS
&
DRAWINGS


BASIN DIVIDE
CAMP DELMONT LAKE DAM
DS
DP
Hart Boy Scout Camp
Delmont Boy Scout Camp
Water Tank
Radio Tower
MILFO
ZIEGLER RD
SWAMP CREEK RD
LONG ROAD
MILLER ROAD
DUTCH RD
WHITES MILL ROAD
CAMP ROAD
PRIDE ROAD
SCOUT ROAD
UPPER RIDGE ROAD
BUTCHER ROAD
KNIGHTS RD
MILL ROAD
DIETZ ROAD
HOUSEMAN ROAD
O R O U G H
DAM LOCATION
PENNSYLVANIA
FIGURE 1
REGIONAL VICINITY MAP
SCALE 1:24000
N


BETHLEHEM
ALLENTOWN
Fountain Hill
Hellertown
Quakertown
BASIN DIVIDE
CAMP DELMONT LAKE DAM
DAM LOCATION
PENNSYLVANIA
FIGURE 1A
REGIONAL VICINITY MAP
SCALE 1·250000
N

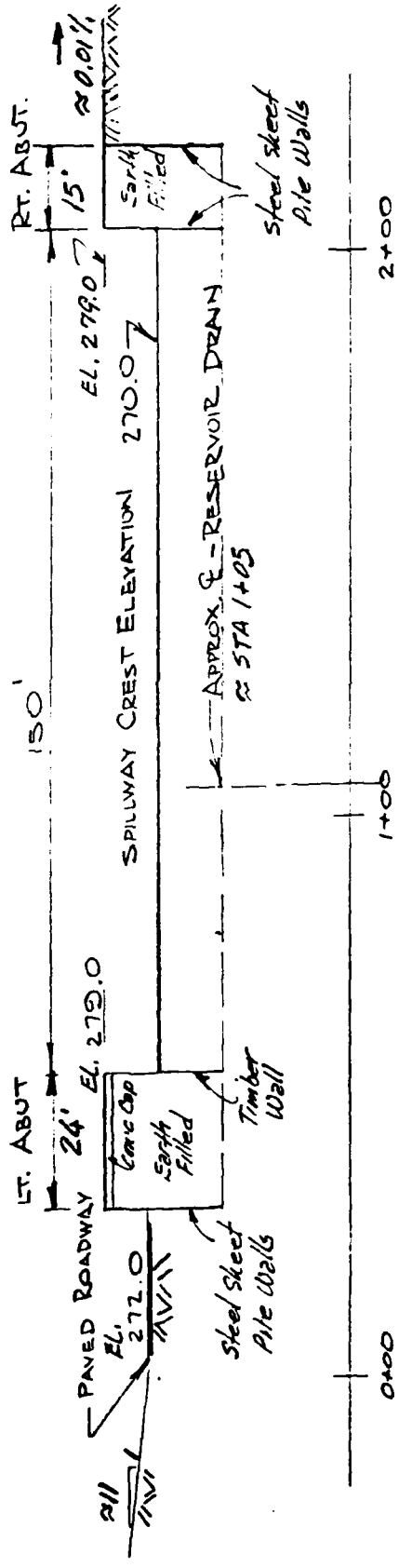
O'BRIEN & GERE ENGINEERS, INC

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	3	RFH	3/5/81	1E41.0-2 111



O'BRIEN & GERE
ENGINEERS, INC.

SUBJECT	SHEET	BY	DATE	JOB NO
CAMP DELMONT DAM	4.	REH	3/3/81	1841 014 111



SECTION ALONG AXIS OF DAM

LOOKING DOWNSTREAM

SCALE: 1" : 30'

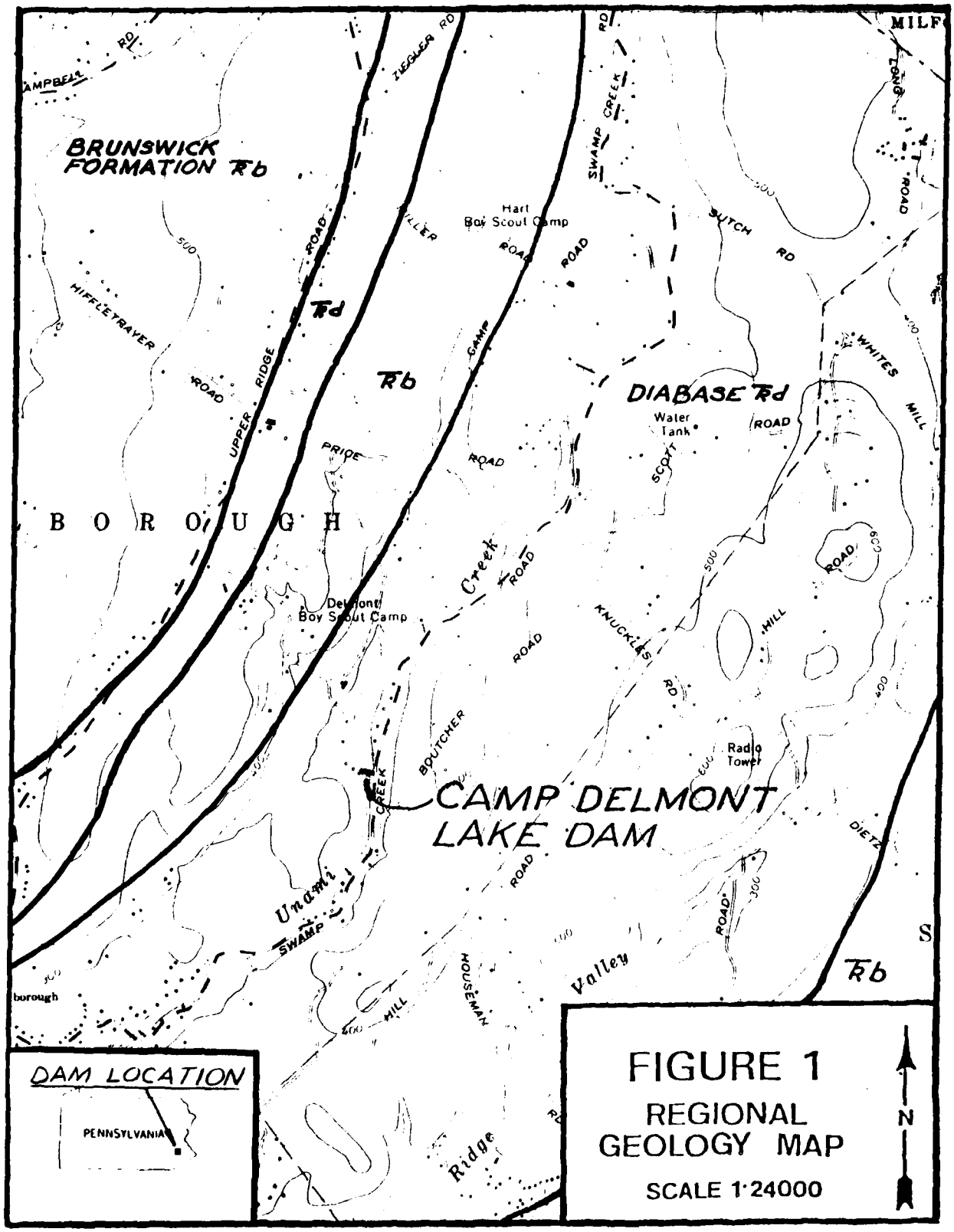
APPENDIX F

GEOLOGY

SITE GEOLOGY

CAMP DELMONT DAM

Camp Delmont Dam is located in the Lowland section of the Piedmont Physiographic Province. As shown on Figure 1, bedrock at the damsite is a Triassic Diabase which is dark gray, medium to coarse grained; composed chiefly of gray plagioclase feldspar and black or green augite. No known active faults are located in the vicinity of the damsite.


BRUNSWICK FORMATION Rb
DIABASE Rd
Rb
Rd
B O R O U G H
CAMP DELMONT LAKE DAM
Hart Boy Scout Camp
Delmont Boy Scout Camp
Water Tank
Radio Tower
Unami SWAMP
Valley
Ridge
UPPER RIDGE ROAD
ZIEGLER RD
SWAMP CREEK
DUTCH RD
WHITES MILL ROAD
KNUCKLES RD
BOUTCHER CREEK
HOUSEMAN HILL
DIETZ
SCOTT ROAD
PRIDE ROAD
HIFFLETRAYER ROAD
CAMP ROAD
borough
DAM LOCATION
PENNSYLVANIA
N
FIGURE 1
REGIONAL GEOLOGY MAP
SCALE 1:24000